

8 October 1964

MEMORANDUM FOR: Chief, Development Branch, P&DS *APM*
12 Oct 64
THROUGH: Chief, Exploratory Development Laboratory Branch, P&DS *PS.*
SUBJECT: Final Report, Project No. 1009 - Screen Evaluation Study
REFERENCES: (a) Memorandum entitled "Screen Evaluation Study"
from Chief, Development Branch, P&DS, dated
25 August 1964
(b) Final Report F. O. 046564, Bausch & Lomb,
"Rear-Projection Screen Materials Study"

1. This project compared three Oude Delft rear-projection screens and the Polacoat screens used on the Richardson model 705V viewer and the NRI two-screen comparator for various aspects of optical performance. The specimen identified as Oude Delft "Wide Angle" appears to be best suited on the criteria of resolution and brightness. These criteria and the measurements used to define them are described below.

2. The first requirement any viewing screen must fulfill is that it should deliver to the viewer all the detail the film and projector optics are capable of presenting in the screen plane. This quality depends in a complicated way upon the fine structure of the diffusing layer of the screen. In general, fine grains of nearly uniform shape, concentrated in a thin layer in intimate optical contact with the screen substrate will produce superior resolution performance. The resolution qualities of the screen samples were measured by examining a high-contrast resolution target projected on the screen. The image was brought into focus with the help of a 10x hand magnifier, then the smallest readable resolution group was determined by eye. Here, the Oude Delft "Narrow Angle" sample showed slightly better performance than any other, closely followed by the Oude Delft "Wide Angle" and the NRI Polacoat.

3. The second most important criterion in the evaluation of rear-projection screens is the distribution of brightness with viewing angle. This property was measured with the screen samples in place by sighting a spot brightness meter through an angular aiming guide and recording the screen brightness through a range of 75 degrees on either side of the normal to the screen. The values determined by this technique were easily reproducible within about 4 percent. The brightness-distribution curves measured are shown in Figure 1. In general, the shape of the brightness curves tells whether the screen is more suited for viewing by an individual or a group. The fatter the curve, the more light is available

off-axis, and the better the view from the side of the screen. This advantage, though, is offset by the better resolution qualities of the narrow-angle screens such as the Oude Delft "Narrow" and the NRI Polacoat. The best compromise between a wide brightness angle and high resolution was offered by the Oude Delft "Wide Angle," whose curve has the property (unique in this group of samples) of having a relatively narrow "nose" combined with a relatively wide base.

4. The angle-of-view advantages of the Oude Delft "Wide" are gained at the expense of a somewhat higher optical density than the other screens. Whereas the Oude Delft "Narrow" transmitted about 32 percent of the projected light, the "Wide" transmitted only about 23 percent. This means that, for the same screen brightness, a projector using the "Wide" screen will need about one-third more light intensity at the film plane than if the "Narrow" screen were used. This minor disadvantage of the "Wide" screen is balanced by the evenness of its density. Whereas the Oude Delft "Narrow" and the Polacoat NRI screens had density variations of over 10 percent, the "Wide" had less than 8 percent, an improvement which was easily noticeable to the eye.

5. Both samples of Polacoat screen showed a moderate amount of prismatic sparkle which gave the image a fine structure of strongly colored points of light. This effect is likely due to the presence of sharp edges and flat surfaces on the grains which make up the diffusing layer. The Oude Delft grains, on the other hand, are apparently more rounded. Although this sparkle does not seem to affect resolution to a significant degree, nearly all viewers felt it to be a slight annoyance.

6. Taking into consideration all the factors discussed here, the screen samples studied may be ranked in the following order: best - Oude Delft "Wide Angle;" next best - NRI Polacoat; third place - for individual viewing, Oude Delft "Narrow Angle;" for group viewing, Polacoat Richardson 705V; last place - Oude Delft "Aerocontrastor." If wide-angle group viewing is of greater importance, Oude Delft "Aero-contrastor" shows the best performance if some sacrifice in resolution can be accepted, as, for example, in a theater.

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